

ANATOMY OF DIGESTIVE TRACT OF THE CHICKEN
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In writing on this subject, the purpose has been to give a few notes that will enable anyone to post mortem a chicken and have some idea of what the normal anatomy should present. The subject is narrowed as title indicates, because chickens are probably the most important division of live stock left largely unstudied and of all systems of organs, those connected with digestion are surely of the greatest economic importance. During the year of 1905, there were 1,500,000,000 dozens of eggs produced in the United States alone, and the present outlook is even brighter than the past record. As the country becomes more populous, the cost of raising other domestic animals will increase, hence a rise in price of meats. For the above reasons and others, the chicken industry is sure to become more important. As it grows so also will the demand for men with a knowledge of their diseases. The intelligent reader of poultry diseases or the veterinarian cannot hope to most thoroughly comprehend these diseases without some conception of the correct conditions and relations of the parts affected. As most poultrymen know, one-half of the chickens dying before marketing are less than a month old and their death at this age is usually from digestive disturbances, therefore to the person who depends upon a brooder for chicks, this subject will possess a peculiar interest. Further I believe the more thorough knowledge of their diseases will stimulate the raising of chickens from a utility standpoint rather than for fancy points, substituting size and quality of bird with increased egg production for fine marks and color of plumage.

In order to present an interesting and instructive discussion on the digestive tract, it will be necessary and proper to give a general idea of the internal organs. Although this treatise is intended to enable one to more satisfactorily carry on Post Mortem

examination and hence the organs should be discussed from the view point of entrance, which is generally from the ventral side, yet as it will be more easily kept in mind, the organs will be described in relation to the whole, when the animal is in the natural standing position.

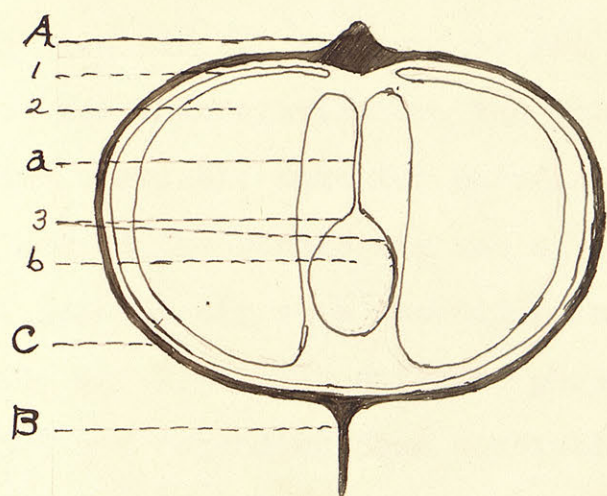
All of the organic systems of a chicken differ largely from their analogues in the mammals, but that which is least similar and most interesting, other than the digestive tract, is the respiratory system which is so intimately related to the digestive tract that it seems necessary to give a synopsis of it.

The nostrils are small. The trachea^h has a larynx at either extremity, the upper one is covered by a membrane with longitudinal slit like aperture for the entrance of air, when it is dilated. The lower larynx or syrinx is the voice box and is located at bifurcation of trachea^h into bronchi. The lungs are located in roof of thorax being deeply indented by vertebral ribs excepting the last two. (The chicken has both vertebral and sternal ribs, the latter replacing the costal cartilages of mammals)

In mammals we know there are two large cavities, the thoracic and abdominal, separated from each other by the diaphragm and each cavity having a serous restricting and directing membranes for its organs, called the pleura and peritoneum respectively. In the chicken which has no diaphragm there can be no distinction made in the membrane. It makes three divisions from near the vertebrae, two on either side for air sacs and one in the middle, which suspends the heart and blood vessels and the great mass of digestive tract.

Anteriorly it is attached below to the sternum making it similar to the mediastinum of mammals, while posteriorly it floats free on intestines like the mesentery. The portion which descends from the median

Fig. 1.



Diagrammatic cross section of the body of a chicken, behind the last rib; with cavity walls, showing

A - vertebrae
B - sternum
C - muscles, skin etc.

1. Serous membrane and arrangement
2. System of air sacs
3. Double membrane (mesentery) enclosing - a. circulatory system
b. digestive "

line is double with blood vessels, nerves etc. between its layer but the portion forming the air sacs is only single and very transparent. The air sacs form convenient land marks when dividing the body cavity into arbitrary sections. All of them aiding in one antero-posterior division, and either extremity of the posterior phrenic makes a good division transversely.

	SUPERFICIAL	MIDDLE	DEEP
	Fat	Intestines	Kidney 1/3
Posterior 1/3	Duodenum	Vas Deferens	
	Pancreas	Ureter	
----- Posterior extremity of posterior phrenic air sacs. -----			
	Gizzard	Testical	Kidney 2/3
Middle 1/3	Duodenum	Spleen	Ureter
	Liver	Gall-bladder	
	Pancreas		
----- Anterior extremity of posterior phrenic air sacs. -----			
	Liver	Proventriculus	Lungs
Anterior 1/3	Heart	Esophagus	Bronchi
		Blood vessels	
		Tracea	

The chicken has nine air sacs (four pairs and one single). The single air sac in front of the lungs and behind the crop is called the interclavicular. The pairs named from before, backwards are the cervical, anterior phrenic, posterior phrenic and abdominal. Just behind the single air sac at entrance of thorax, will be found a small pair of air sacs extending into the humerus of the wing. These are the cervical. The anterior phrenic are pyramidal, the apex being forward and extending from cervical air sacs to posterior border of the lung, where it meets the base of the posterior phrenic, which is also pyramidal, apex posteriorly, being located below and external to the abdominal sacs. The abdominal sacs which extends from lungs to cloaca, are by far the largest and could easily fill the entire cavity, if inflated to full extent. Attached to the inner side of the visceral wall of abdominal sacs for nearly their whole extent, are the vas deferens and uterus. (Fig. 1.) Each of these sacs is connected with the lungs but not with each other, this arrangement will do much to explain how the respiratory tract (abdominal sacs) may be punctured in castrating with ^{out} serious consequences to the patient. Figures 2 and 3 will give some idea of extent of sacs.

Fig. 2

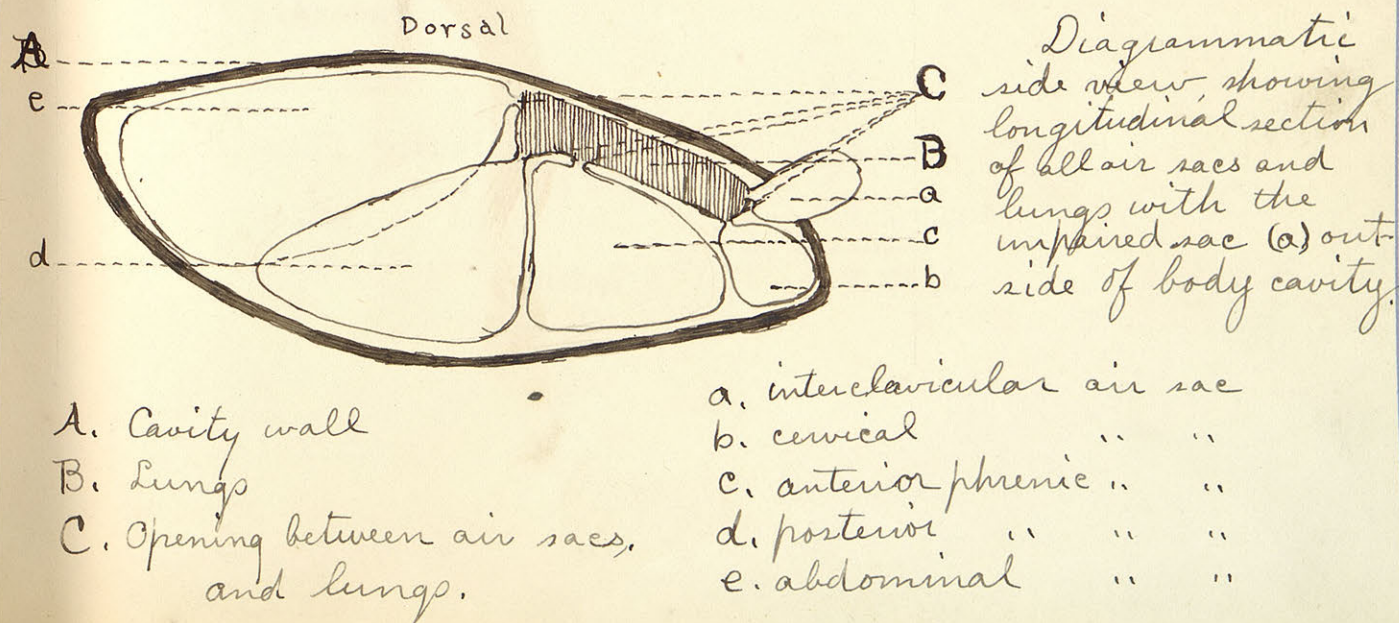
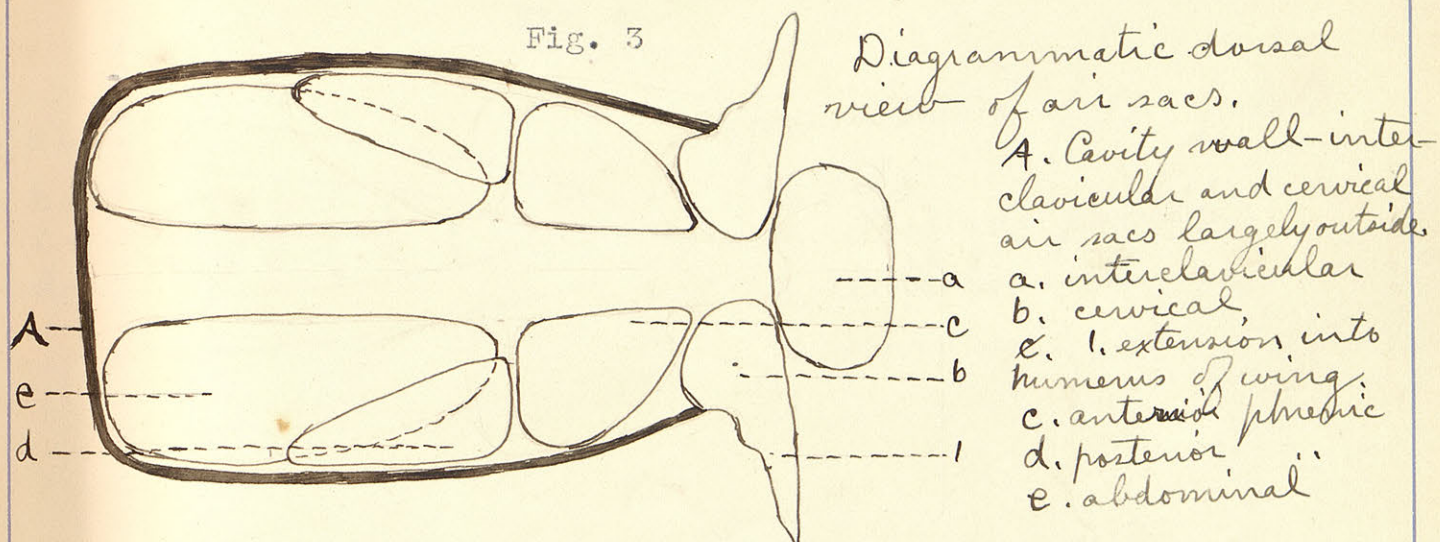


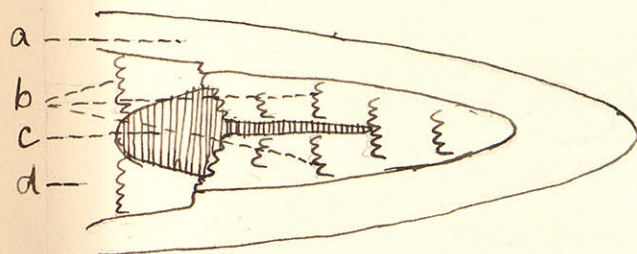
Fig. 3



The discussion of the digestive organs is given with intention of describing their position and relation in situ together with thier shape and color. Before further remarks, it is well to observe the following divisions, using the mature cock as the type.

Fauces	2 inches
Cervical Esophagus	6 "
Distended " (Crop)	4 "
Dorsal "	5 "
Succentric Ventrical	2 "
Gingerum	3 "
Duodenum	12 "
Small intestine	5 feet
Colon	6 inches.
Total	8 feet.

Fig. 4



Representation of the palate.
 a. bill
 b. retrograde papillae
 c. cleft to nose
 d. pharynx.

FAUCES

The tongue is sharp pointed in front, becoming $\frac{3}{8}$ " broad at base, where there is a transverse fringe of stiff retrograde papillae. The pallet is cleft longitudinally and has five transverse rows of retrograde papillae about $\frac{1}{4}$ " apart, the first row being opposite the similar row at base of tongue. These papillae with the aid of those on the tongue, are the chief means of forcing food into the pharynx. The posterior portion of cleft is broad and is the opening of the nasal cavities. These organs form the floor and roof of fauces respectively, while the sides are bound by membranous cheeks as the chicken has little need of any masticatory muscles here.

CERVICAL ESOPHAGUS

The posterior portion of fauces (The pharynx) is the anterior part of this esophagus. At the base of the pharynx anteriorly is noticed a slit like aperture (before mentioned). This is the laryngeal orifice and its lips have similar functions to the epiglottis of mammals. The esophagus being made up largely of yellow elastic tissue is very distensible but its normal lumen is about $\frac{1}{2}$ inch.

The mucus coat of this portion is very loose and voluminous so that it is normally thrown into rugae. As it is thickly studded with

mucus glands, this arrangement gives greater surface for the glands &

DISTENDED ESOPHAGUS (Crop)

This section may be considered as a dilatation of the previous division and lies just anterior to first ribs, marking the division between the cervical and dorsal portions. It is rather pouch-like and when fully distended, is capable of holding a pint. This organ is similar in function to the rumen of a cow, in that it aids largely in maceration.

DORSAL ESOPHAGUS

This divisions is hardly as distensible as the preceeding portions and has fewer glands. Its lumen is about the same as cervical portion throughtout.

Relations

- SUPERIOR -----Lungs, longus colimuscle, vertebrae
- INFERIOR-----Trachea^h, syrnyx, heart, thymus, large vessels.
- RIGHT ----- Heart, right bronchus.
- LEFT -----Left bronchus, vertebrae.

The esophagus as a whole is a means of conveyance besides adding necessary secretions to aid digestion. It is pink, as is the whole intestinal tract except caeca. At its pharyngeal extremity, the esophagus is above the trachea^h but these soon separate, the trachea^h keeping to the left and esophagus to the right of the vertebrae, till they reach the thorax. Here the trachea^h is crossed on middle line at the syrinx by the esophagus, which continues on left side of vertebrae to the proventriculus as the dorsal esophagus.

PROVENTRICULUS

The secreting organ often known as the glandular stomach because of its numerous secreting papillae (10 or 12 to the inch) and thich mucus walls, is a soft body about the size and shape of a butternut. The brown mucus secreted, is very viscid and supposed to contain pepsin, amylopsin, and HCL. A transverse plane drawn between the fourth ribs, marks its anterior extremity as well as that of the liver and testicles.

Relations.

SUPERIOR ~~and~~-----Left testicles, spleen, lung, intestines.

INFERIOR- ----- Liver

ANTERIOR-----Esophagus

POSTERIOR -----Gigerum.

GIGERUM

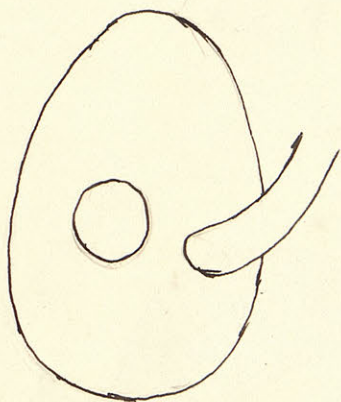
This organ, better known as the gizzard, is about the shape of a lima bean and is very strong and muscular. It is made up of dark red muscle except that at center of sides; which is tendonous, the tendons being the attachment of these muscles to each other. The walls of the gigerum are very thick, varying from one-half to one inch in thickness. Late evidence shows that this organ with its yellow, horny covered mucus membrane, secretes a fluid with some active principle, probably pepsin and others, the nature of which is still an open question. This yeppow horyⁿ covering does serve a useful purpose, in that, as this organ contains all manner of grit, pebbles etc., when the powerful muscular walls contract, trituration of the food is perfect. It is arranged in distinct ridges, upon which are numerous, minute, teeth-like papillae, which form a valuble aid to the grinding proficiency. The organ is located on median line

just above the posterior end of sternum and behind the last rib.

There are two openings into it, being at anterior edge, Figs. 5 and 6.

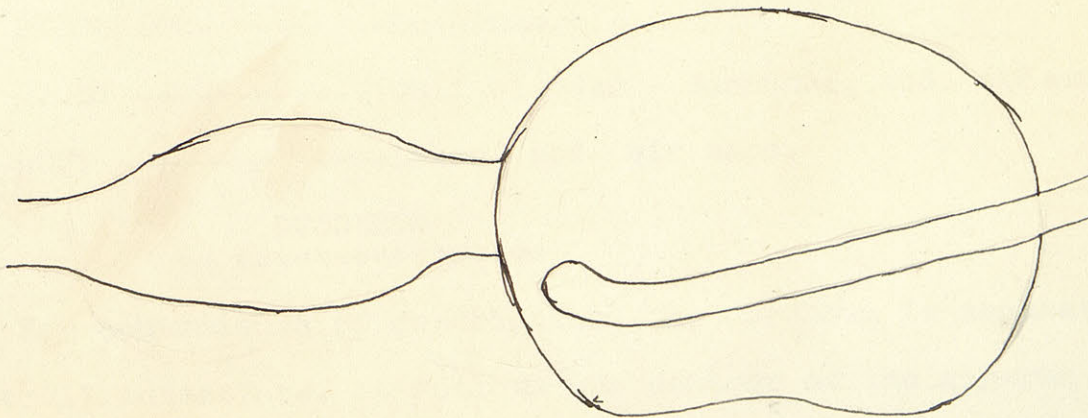
the entrance to the proventriculus to the left and the duodenal to the right. Figures 5 and 6, show gigerum with, proventriculus and short portion of duodenum, in the anterior and side view respectively.

Fig. 5



Front End View

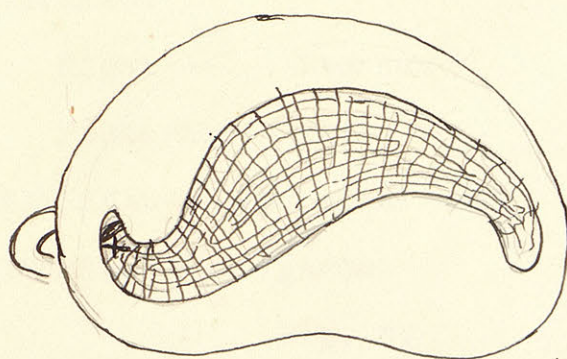
Fig. 6



Side view of Gigerum with Proventriculus
on left.

Figure 7, shows section through middle, longitudinally the thickness and irregularity of the walls and the horny lining with rugae. Figure 7 - X shows orifice of duodenum, which is between two portions of the walls (a valve being formed thus) which arrangement retains the food for trituration before its exit. The capacity of this organ is only about one-sixth pint and is practically always constant, as the thick walls offer little elasticity.

Fig. 7



Relations

SUPERIOR ----- Intestines, abdominal air sacs.
 INFERIOR ----- Mediastinum.
 ANTERIOR ----- Liver, proventriculus, left testicle.
 POSTERIOR----- Duodenum.
 RIGHT ----- Gall bladder - duodenum, abd. air sacs.
 LEFT ----- Liver, abd. air sacs.

DUODENUM

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For convenience of description, the duodenum is separated from other small intestines. It follows the contour of the gigerum from its anterior extremity to the right and finally gains the

posteriorⁿ extremity on the left side, where it makes a loop, returning to near its origin; both portions being closely connected with pancreas between them by mesentery. The duodenum is the lowest portion of intestine and is easily recognized on effecting entrance in post mortem by its peculiar arrangement shown by figure 8.

Relations.

SUPERIOR

Right----Intestine, abd. air sacs.

Posterior--Colon, ureter, semeniferous tubules.

INFERIOR

Right -----Sternum

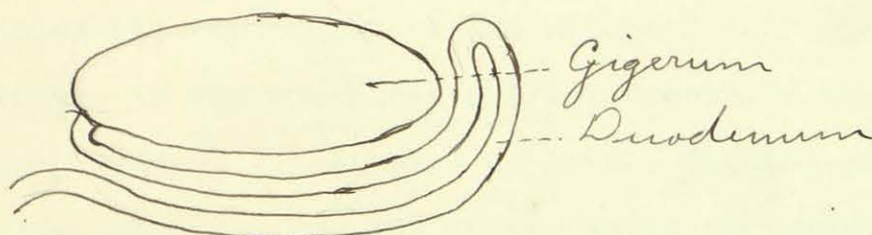
Posterior---Fat

EXTERNAL----Abdominal wall

INTERNAL----Gigerum.

Fig. 8.

Ventral view



INTESTINES

The ileum and jejunum which are included in this term, form a coiled mass between the air sacs and gigerum, terminating in the large colon at juncture of caeca, which is located generally between the testicles.

Relations

SUPERIOR----Air sacs, testicles, kidneys.

INFERIOR---- Gigerum, duodenum, liver.

EXTERNAL----Air sacs.

COLON

This canal is larger in its whole extent, than the preceeding one; but just before ending, it enlarges greatly and terminates in the cloaca.

Relations

SUPERIOR-----Spines, vessels.

INFERIOR -----Intestines.

EXTERNAL-----Uretus , seminiferous tubules.

CLOACA

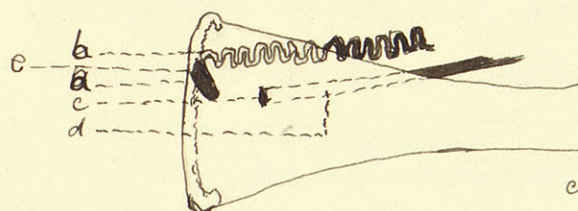
At posterior extremity of the chicken, corresponding to the anus of mammals, is the excretory orifice common to the digestive and genito-urinary systems. It appears to be the dilated continuation of the large colon, with the opening in its walls for semen and urine. Posteriorly, it is constricted by muscular fibres and it is here that two large papillae are located about in the middle of the lateral sides for the excretion of semān. Behind and below these, in the walls, are the valvular openings for the urine from the uretus^{ers}.

Relations

ANTERIOR -----Linea alba, caeca, intestines.

EXTERNAL -----Skin.

Fig. 9



a. Muscular constriction at exit of cloaca.

b. Vas deferens - the light portion is that which would be hidden in this view by cloacal wall.

c. Opening of ureter

d. Ureter - the light

portion is that which would be hidden by cloacal wall.
 e. Penis-like papillae for directing and ejaculating the semen from the vas deferens.

Figure 9, shows one wall of the cloaca.

LIVER

On either side of the mediastinum, is a large, brown, irregularly shaped organ, the liver, suspended just behind the heart, as is the spleen, gall bladder, intestines and others, giving an easy and natural passage for the blood-vessels, (similar to the anterior mesenteric of mammals). The left lobe occupies a space marked by the last four ribs and divided into two portions by a deep fissure.

Relations.

SUPERIOR-----Proventriculus, esophagus, lungs, testicle

INFERIOR-----Sternum

ANTERIOR-----Heart

POSTERIOR-----Gigerum

The right lobe is larger and has a deep cleft on its

inner side for the gall-bladder.

Relations

SUPERIOR ----- Lungs, testicle, gall-bladder, duodenum.

INFERIOR ----- Sternum

ANTERIOR-----Heart

POSTERIOR-----Gigerum, duodenum

Both lobes are in proximity to air sacs externally.

PANCREAS

The pancreas is a long, slender, tri-lobed pink organ, being enclosed on either side by duodenum, hence has same position. and relations

GALL-BLADDER

Located in the right lobe of liver, is a small pickled shaped green body about one inch in length, for the storage of bile. This is the gall-bladder and is entirely encased by the liver, duodenum and mesentery.

CAECA

The caeca are two black or brown blind pouches varying in size, from that of the small intestine to the largest part of the colon. Origin is near the last rib, from there it extends backwards, in a serpentine course, loosely attached on each side of ileum by mesentery, to the cloaca. It is related to intestines.

HEN

The hen, having only one ovary, this can only replace one testicle in the description. The oviduct, however, is much larger than the semeniferous tubules and hence would have more relations. During laying season, the whole genital canal of hen is hypertrophied,

crowding the abdominal air sacs into a small space and forcing the other organs to the other side. It would require much study to give a working idea of relations of abdominal organs of a laying hen, as there is nothing constant.